

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the system further comprising:

an optical path control device manager coupled to the plurality of nodes via a transmission line, the optical path manager comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, and said optical path control device section controlling an optical path setting settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface;

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table;

means for sharing said spare optical path among said current optical paths having different routes;

means for, when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

means for, when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

2. (Currently Amended) A node of a wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the system further comprising:

an optical path control device manager coupled to the plurality of nodes via a transmission line, the optical path manager comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared

table, ~~and said optical path control device~~ section controlling an optical path setting settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface;

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table;

means for sharing said spare optical path among said current optical paths having different routes;

means for, when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

means for, when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

3. (Currently Amended) A wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the system further comprising:

an optical path control device manager coupled to the plurality of nodes via a transmission line, the optical path manager comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, and said optical path control device section controlling an optical path setting settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface;

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table; and

means for sharing said spare optical path among said current optical paths having different routes.

4. (Original) A system according to claim 3, further comprising means for setting said current optical path between nodes by a shortest route.
5. (Original) A system according to claim 3, further comprising means for setting said current optical path and said spare optical path in two ways between nodes.
6. (Currently Amended) A wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the system further comprising:
- an optical path ~~control device~~ manager coupled to the plurality of nodes via a transmission line, the optical path manager comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, ~~and said optical path control device~~ section controlling an optical path setting settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface;
- means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare

optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table;

means for sharing said spare optical path among said current optical paths having different routes, and, when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

means for, when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

7. (Currently Amended) A wavelength division multiplexing ring network system, which comprises a plurality of nodes for transmitting and receiving a plurality of optical signals having different wavelengths, terminating optical paths, and switching connections of said optical paths, and a network manager connected to at least one node, and in which said nodes are connected into the form of a ring via at least a clockwise optical transmission line and a counterclockwise optical transmission line, and an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the system further comprising:

an optical path ~~control device~~ manager, included in the network manager, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, ~~and said optical path control device section controlling an optical path setting~~ settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface;

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table,

said network manager including optical path requesting means for requesting at least one node forming an optical path to set an optical path;

said node including optical path setting means for setting an optical path between nodes forming an optical path on the basis of the request from said network manager;

said optical path requesting means including means for checking whether an optical path can be set, means for determining a node to be requested to set an optical path, and means for checking whether said spare optical path can be shared,

said optical path setting means including means for setting an insertion wavelength of an optical path, means for setting a conversion wavelength of an optical path, and means for setting a branching wavelength of an optical path,

said means for checking whether said spare optical path can be shared including means for determining that said spare optical path can be shared when routes of said current optical paths set between nodes do not overlap, and requesting at least one node to set an optical path so as to form a new spare optical path by sharing an existing spare optical path, and

said optical path setting means including means for forming a new spare optical path by sharing a wavelength used by an existing spare optical path, when requested by said network manager to form the new spare optical path by sharing the existing spare optical path.

8. (Currently Amended) An optical path setting method in a wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via the transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of the optical paths, and an optical path ~~control device~~ manager, coupled to the plurality of nodes via a transmission line, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, and said optical path control ~~device~~ section controlling ~~an optical path setting~~ settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the method comprising:

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node, based on at least information from the structure control table and the optical path shared table;

sharing the spare optical path among the current optical paths having different routes;

when a node which terminates the current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both the current optical path and the spare optical path, sending an alarm signal to an opposite node of the current optical path having the trouble, and switching inputting of optical signals to the spare optical path; and

when a node which terminates the current optical path detects the alarm signal, outputting an optical signal to both the current optical path and the spare optical path, and switching inputting of optical signals to the spare optical path.

9. (Currently Amended) An optical path setting method in a wavelength division multiplexing ring network system, which comprises a plurality of nodes for transmitting and receiving a plurality of optical signals having different wavelengths, terminating optical paths, and switching connections of the optical paths, a network manager connected to at least one node, and an optical path control device manager, included in the network manager, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, ~~and said optical path control device~~ section controlling an optical path setting settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface, and in which the nodes are connected into the form of a ring via at least a clockwise optical transmission line and a counterclockwise optical transmission line, and an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the method ~~comprising the steps of:~~

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node, based on at least information from the structure control table and the optical path shared table;

causing the network manager to request at least one node forming an optical path to set an optical path;

causing the node to set an optical path between nodes forming an optical path on the basis of the request from the network manager;

checking whether an optical path can be set, determining a node to be requested to set an optical path, and checking whether the spare optical path can be shared;

setting an insertion wavelength of an optical path, setting a conversion wavelength of an optical path, and setting a branching wavelength of an optical path;

checking whether the spare optical path can be shared to determine that the spare optical path can be shared when routes of the current optical paths set between nodes do not overlap, and requesting at least one node to set an optical path so as to form a new spare optical path by sharing an existing spare optical path; and

forming a new spare optical path by sharing a wavelength used by an existing spare optical path, when requested by the network manager to form the new spare optical path by sharing the existing spare optical path.

10. (Currently Amended) An optical path setting method in a wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, ~~and~~ a plurality of nodes connected into the form of a ring via the transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of the optical paths, and an optical path control device manager, coupled to the plurality of nodes via a transmission line, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, ~~and said optical path control device section controlling an optical path setting settings of optical paths among the plurality of nodes~~ in accordance with information transferred via a the communication interface, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the method comprising:

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node, based on at least information from the structure control table and the optical path shared table; and sharing the spare optical path among the current optical paths having different routes.

11. (Original) A method according to claim 10, wherein the current optical path is set between nodes by a shortest route.

12. (Original) A method according to claim 10, wherein the current optical path and the spare optical path are set in two ways between nodes.

13. (Currently Amended) A recovery method in a wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, ~~and~~ a plurality of nodes connected into the form of a ring via the transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of the optical paths, and an optical path ~~control device~~ manager, coupled to the plurality of nodes via a transmission line, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, ~~and said optical path control device~~ section controlling an optical path setting settings of optical paths among the plurality of nodes in accordance with information transferred via a the communication interface, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, the method comprising:

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node, based on at least information from the structure control table and the optical path shared table;

sharing the spare optical path among the current optical paths having different routes;

when a node which terminates the current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both the current optical path and the spare optical path, sending an alarm signal to an opposite node of the current optical path having the trouble, and switching inputting of optical signals to the spare optical path; and

when a node which terminates the current optical path detects the alarm signal, outputting an optical signal to both the current optical path and the spare optical path, and switching inputting of optical signals to the spare optical path.

14. (Currently Amended) A computer readable medium storing a program for setting an optical path in a wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, ~~and~~ a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and an optical path manager, coupled to the plurality of nodes via a transmission line, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, said optical path control section controlling settings of optical paths among the plurality of nodes in accordance with information transferred via the communication interface, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table;

sharing said spare optical path among said current optical paths having different routes;

when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and

said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

15. (Currently Amended) A computer readable medium storing a program for setting an optical path in wavelength division multiplexing ring network system, which comprises a plurality of nodes for transmitting and receiving a plurality of optical signals having different wavelengths, terminating optical paths, and switching connections of said optical paths, ~~and~~ a network manager connected to at least one node, and an optical path manager, included in the network manager, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, said optical path control section controlling settings of optical paths among the plurality of nodes in accordance with information transferred via the communication interface, and in which said nodes are connected into the form of a ring via at least a clockwise optical transmission line and a counterclockwise optical transmission line, and an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path

on a route reverse to said current optical path extending from said start node to said end node,
based on at least information from the structure control table and the optical path shared table;

causing said network manager to request at least one node forming an optical path to set
an optical path;

causing said node to set an optical path between nodes forming an optical path on the
basis of the request from said network manager;

checking whether an optical path can be set, determining a node to be requested to set an
optical path, and checking whether said spare optical path can be shared;

setting an insertion wavelength of an optical path, setting a conversion wavelength of an
optical path, and setting a branching wavelength of an optical path;

checking whether said spare optical path can be shared to determine that said spare
optical path can be shared when routes of said current optical paths set between nodes do not
overlap, and requesting at least one node to set an optical path so as to form a new spare optical
path by sharing an existing spare optical path; and

forming a new spare optical path by sharing a wavelength used by an existing spare
optical path, when requested by said network manager to form the new spare optical path by
sharing the existing spare optical path.

16. (Currently Amended) A computer readable medium storing a program for setting an optical path in a wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, ~~and~~ a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and an optical path manager, coupled to the plurality of nodes via a transmission line, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, said optical path control section controlling settings of optical paths among the plurality of nodes in accordance with information transferred via the communication interface, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table; and

sharing said spare optical path among said current optical paths having different routes.

17. (Previously presented) The computer readable medium according to claim 14, further comprising a program for causing said computer to execute the procedure of setting said current optical path between nodes by a shortest route.

18. (Previously presented) The computer readable medium according to claim 16, further comprising a program for causing said computer to execute the procedure of setting said current optical path and said spare optical path in two ways between nodes.

19. (Currently Amended) A computer readable medium storing a program for realizing a recovery method in a wavelength division multiplexing ring network system, which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and an optical path manager, coupled to the plurality of nodes via a transmission line, comprising a communication interface which transfers information between an IP router or another device and an operator, an optical path control section, a structure control table, an optical path control table, and an optical path shared table, said optical path control section controlling settings of optical paths among the plurality of nodes in accordance with information transferred via the communication interface, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node, based on at least information from the structure control table and the optical path shared table;

sharing said spare optical path among said current optical paths having different routes;

when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

20. (New) The system of claim 1, wherein the structure control table is generated based on information exchanged with the operator via the communication interface in the optical path manager.

21. (New) The system of claim 1, wherein the structure control table is generated based on information exchanged between the optical path manager and an optical path controller included in one of the plurality of nodes.